

First Progress Report

NOAA SARP Grant 06350

Sharpening Drought Plans by Considering Climate, the Watershed, the Regulatory Environment, and the Forces of Change

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May 2008

Introduction

This progress report describes activity to date on a NOAA SARP Grant being implemented in collaboration with the El Dorado Irrigation District (EID) in Placerville California. Two of the project partners, SEI-US and NCAR, have been engaged with EID in collaborative research for nearly two years. This work has focused on assisting EID to integrate climate change into its planning and decision-making processes. Early work focused on the drought preparedness plan that EID is developing, and it led to the development of a WEAP application of the EID system that included representations of both the rainfall runoff processes at work in the EID source watershed and the operation of EID's installed hydraulic infrastructure. Several simplifying assumptions were made in developing this early application of WEAP. These include:

- That the hydraulic infrastructure was static and that no new features would be added in the future;
- That the regulatory regime governing the operation of that hydraulic infrastructure was static, and
- That the water demands that drives system operations in the model could be lumped into a single demand for each of five service areas in the EID system.

The NOAA grant proposed to improve on these assumptions in order develop a tool that could provide a much more refined assessment of the risks that climate change poses for EID and of the expected performance of various adaptation strategies in the face of these risks. This report includes a description of the progress that has been made in improving on each of these assumptions

Adding New Features to the Model of the EID Ssystem

Through a series of meeting with key managers at EID, the research team narrowed a list of potential water management improvements suggested by EID to a smaller set that could be accommodated in the WEAP model and that offered the potential for climate change adaptation. The final list of adaptation measures that will be investigated as part of this research includes:

- Continued refinement of the proposed drought plan triggers and actions;
- Increases in water conservation measures, including pricing mechanisms;
- Construction of a new on stream storage facility;
- Construction of a facility for the storage of treated wastewater to be used later in the water year;
- Implementation of a conjunctive use/groundwater banking project with downstream water management entities; and
- Implementation of short-term water storage agreements with upstream hydropower producers.

Each of these potential adaptations is being programmed into the EID WEAP application as scenarios that tier off of the reference baseline already developing the original WEAP application.

Adjusting the Regulatory Regime Governing System Operations

The main regulatory drivers governing the operation of the EID system are flow targets below EID storage facilities and major points of diversion. These flow targets were set in order to protect important aquatic ecosystems in the rivers and streams managed by EID. Another critical component of protecting these ecosystems is the maintenance of acceptable water temperatures. There is fear that under climate change it may be increasingly difficult to manage water temperatures to the benefit of cold water fish.

In order to assess this potential threat, the water temperature simulation capability of WEAP is being enhanced. At the current time WEAP contains routines that track the temperature of water as it moves downstream, assuming that the temperature of the runoff water and the releases from dams can be stipulated. These too are subject to climate change, however, and the EID WEAP application is being upgraded to reflect this reality. A simple model of reservoir water temperature, including the potential for reservoirs to stratify, has been developed and tested, as has a routine to adjust the temperature of lateral inflow to streams as a function of the contribution of snow melt and rainfall runoff. The next step will be to link these routines to the WEAP application and to use them to estimate ecosystem conditions under a range of future climate scenarios and adaptation measures.

Dis-Aggregating Water Demand in the EID Service Area

The key feature of the proposed NOAA research, and the reason UCB was added to the research team, is the ability to assess the financial risk posed by climate change to both EID and its customers under a range of climate futures and potential adaptation investments. To accomplish this, the level of demand aggregation carried out in the original EID WEAP application will not suffice. It must be dis-aggregated into the various classes of uses and between the different regions of the EID service area, which experience very different climate conditions as a result of the large elevation change within the District. This will be accomplished by dividing the District into 19 sectors and the uses within each

sector into 12 use classes. These are the use classes the EID uses in its own water use and billing database and they reflect differences in housing type and lot size as well as creating special classes for agricultural, commercial and industrial customers. To date the original five lumped demand nodes have been removed from the model and have been replaced with demands associated with the 19 sectors and 12 user classes. The uses that are climatically driven, namely landscaping and irrigation, have been formulated in such a manner that the demand can be climatically driven according to the assumed climate scenario.

The next step toward the goal of assessing the financial risk and performance of adaptation measures is to develop an econometric model of water use for each of the categories of water use. UCB has received the required data from EID along with prompt support answering questions about the database. Currently the data are being checked, cleansed to remove inconsistencies (e.g. consumption levels recorded as being zero or negative), and set up in the format required for econometric estimation. In addition, additional variables are being installed in a compatible format with the consumption data, including prices (which vary by time and which have to be inputted in a manner tailored to the block in which each user's consumption falls); demographic variables (tailored to the median for the census block group in which the household is located); weather variables (these vary over time and are tailored to a 3-kilometer grid cell in the PRISM data system); and ET (this varies over time and is based on CIMIS data for the EID region).

While the laborious work of data cleansing and formatting is being performed, the econometric software that will be used to develop the use models have been programmed and tested. The software was successfully tested on a small version of the data and is now being tested on successively larger subsets of the data and variables, pending completion of the full data set. The end result will be a model that can simulate water demand in each use category as a function of water price and climate data. Deliveries in response to this demand will be tracked in the WEAP application to simulate revenues generated by EID under the future scenarios. Shortage cost incurred by EID customers when deliveries fail to satisfy demand will be estimated according to the shadow value provided by the models. These revenues and costs associated with each scenario will be combined with the cost of the adaptation measures to assess the financial performance of each investment strategy. As the model will be run using multiple climate scenarios, this analysis should yield an assessment of the financial risk posed by climate change and the financial performance of proposed adaptation.

Next Steps

With the next three months all of the elements described above will have been successfully integrated into the WEAP application of the EID system. This will allow the project to move into its analysis and conclusions phase, as was anticipated for the second year of the project under the original grant application.

Administrative Issues

The negotiations between NOAA and SEI-US required to execute the final award agreement were protracted. This was due in large measure to the lack of historical audited financial statements for SEI-US, which was incorporated as an independent 501(c)3 organization in April 2006. . In fact, the first financial audit for SEI-US (fiscal year ended December 31, 2006) was completed only in September 2007. Data from this first audit was then used to develop an indirect cost rate, and the execution of agreement with NOAA was then completed in that same month.

Once the prime contract was in place work on the sub-contracts with NCAR and UCB was initiated. These proved somewhat difficult to negotiate while trying to accommodate uncertainty over the availability of the second year of funding budgeted for this award. SEI-US eventually managed to secure subaward agreements that satisfy the terms of the prime agreement. This was not accomplished, however, until well into 2008.

Fortunately, research colleagues from NCAR and UCB initiated work on the project once the prime award was signed, based on the expectations that the sub-awards would be successfully executed.

One final administrative issue to comment on concerns the wonderful support we have received from EID in executing this project. They have provided data, answered endless questions and graciously hosted numerous meetings. This project would not be as successful as it has been without their help. Once caution to point our going forward concerns that the main point of contact for the project within EID. This person is experiencing some health issues that may limit her ability to engage in the coming months. Based on the strong relationships established between the research team and her staff, however, this should not present a hinderance with project progress.

Financial

As of May 30, 2008, costs incurred directly by SEI-US totaled \$9,692 out of the budget allocated (to SEI-US) of \$19,431. UCAR and UC Berkeley have not yet submitted any invoices for costs incurred against their first year budget allocations (\$29,235 and 46,910, respectively), but we anticipate receiving invoices that will cover the full first year's budget period on or soon after July 31, 2008.